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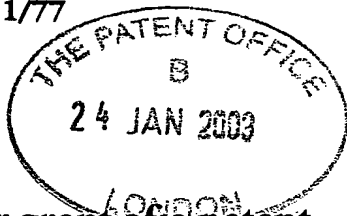


Signed

Dated

23 December 2003

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1/77
27JAN03 E779857-3 D00016
P01/7700 0.00-0301687.0

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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| | | | |
|--|--|---|--|
| 1. Your reference | DW/RM/02617GB | | |
| 2. Patent application number (The Patent Office will fill in this part) | 0301687.0 | | |
| 3. Full name, address and postcode of the or of each applicant (underline all surnames) | RADIX SYSTEMS LIMITED UNIT D3/D4 PREMIER CENTRE ABBEY PARK, ROMSEY HAMPSHIRE SO51 9AQ | | |
| 04142857002 Patents ADP number (if you know it) | | | |
| If the applicant is a corporate body, give the country/state of its incorporation | | | |
| 4. Title of the invention | METHOD AND APPARATUS FOR INSPECTING ARTICLES | | |
| 5. Name of your agent (if you have one) | Brookes Batchellor | | |
| "Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode) | 102-108 Clerkenwell Road London EC1M 5SA ENGLAND | | |
| Patents ADP number (if you know it) | 08142291001 ✓ | | |
| 6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number | Country | Priority application number (if you know it) | Date of filing (day / month / year) |
| 7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application | Number of earlier application | | Date of filing (day / month / year) |
| 8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if: | Yes | | |
| a) any applicant named in part 3 is not an inventor, or b) there is an inventor who is not named as an applicant, or c) any named applicant is a corporate body. See note (d)) | | | |

Patents Form 1/77

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| Continuation sheets of this form | 0 |
| Description | 4 |
| Claim(s) | 2 |
| Abstract | 0 |
| Drawing(s) | 2 + 2 <i>PL</i> |

10. If you are also filing any of the following, state how many against each item.

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| Priority documents | 0 |
| Translations of priority documents | 0 |
| Statement of inventorship and right to grant of a patent (<i>Patents Form 7/77</i>) | 0 |
| Request for preliminary examination and search (<i>Patents Form 9/77</i>) | 0 |
| Request for substantive examination (<i>Patents Form 10/77</i>) | 0 |
| Any other documents (<i>please specify</i>) | 0 |

11.

I/We request the grant of a patent on the basis of this application.

Signature

Brookes B. B. B.

Date

24.01.2003

12. Name and daytime telephone number of person to contact in the United Kingdom

WEITZEL, David Stanley
020 7253 1563

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METHOD AND APPARATUS FOR INSPECTING ARTICLES

This invention relates to a method and apparatus for inspecting articles.

The background to the invention will be explained with respect to a particular application. The invention is not limited to this, however, and other applications may
5 occur readily to the reader.

In the preparation of leaf "prepared" vegetables, e.g. salads, spinach etc, the vegetables are inspected for blemishes and the presence of pests, e.g. caterpillars, slugs and insects. Inspection is difficult, for example leaves tend to stick together, pests tend to hide in folds in the leaves, and turning the leaves to view all surfaces is difficult
10 and onerous. Inspection is carried out manually. Operatives turn and inspect the product as it passes on a moving belt. There are a small but significant number of blemishes and pests missed.

Whilst it is not envisaged that such problems can be totally eliminated, in an effort to reduce their incidences the invention provides apparatus for inspecting articles,
15 comprising a hollow drum having permeable walls and at one end an inlet for receiving articles onto an inside surface of the permeable walls; means for rotating the drum about an axis having at least a horizontal component at such speed that centrifugal force acting on the articles is sufficient to overcome the force of gravity acting on the articles, and progressing means for applying a first jet of fluid to the articles through the
20 permeable wall, to displace the articles from the inside surface and in a direction away from the inlet. As the jet progresses the article, it is likely to turn it over. Most preferably, one or more first jets are sufficient to give a very high chance of the articles being turned in passage through the drum.

The apparatus preferably includes rejection means for selectively applying a
25 second jet of fluid to project rejected articles into means for removing rejected articles from the drum.

Dependent on the material of the drum, the articles can be inspected from inside or outside the drum. Preferred apparatus includes an inspection camera directed at the inside surface of the permeable wall, and control means responsive to the output from camera to reject articles according to predetermined criteria and to operate said rejection
5 means to apply said second jet of fluid selectively to remove the rejected articles.

The rejection means is preferably operable to apply a plurality of second jets individually selectable, and wherein the control means is operative to analyse output from the camera to select one or more second jets.

The camera is a preferably line scan camera.

10 In order to ensure an article is conveyed round the drum between successive visits to a or the first jet this is arranged to displace articles in a direction having a component normal and in the direction of rotation.

The invention also extends to a method for inspecting articles, comprising conveying the articles through an inlet and onto an inside surface of permeable walls of
15 a hollow drum; rotating the drum about an axis having at least a horizontal component at such speed that centrifugal force acting on the articles is sufficient to overcome the force of gravity acting on the articles, and applying a first jet of fluid to the articles through the permeable wall, to displace the articles from the inside surface and in a direction away from the inlet.

20 One embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic pictorial view of inspection apparatus embodying the invention; and

Figure 2 is an end view of the apparatus of Figure 1.

25 Referring to the drawings, a hollow drum 2 has open ends 6 and 8 and permeable walls 10. The walls may, for example be a perforate sheet material or mesh. The drum 2 is supported at each end by four rollers 12 (shown only at one end in the drawings) at

least one of which is driven so as to rotate the drum about an axis X-X which is or has at least a component which is horizontal. Generally the axis will be horizontal. The drum is driven at such a speed that articles, e.g. leaf vegetables, introduced at the end 8, constituting an inlet, and falling onto the inside surface of the walls 10 are, unless
5 rejected, carried in a complete revolution round the drum as it rotates. That is the centrifugal force on the leaves is sufficient to overcome the force of gravity.

As the leaves pass an inspection line 14, they are illuminated by light sources 16. The inspection line 14 is viewed by a line scan camera 18 which provides a pixel by pixel output to control means (not shown) which is operative to compare the output with
10 predetermined criteria to determine whether an article is acceptable or should be rejected, e.g. to identify a blemish or pest on a leaf. The criteria may be based on colour.

As or if the revolving leaf returns or reaches the bottom of the drum it passes a jet bar 20. This is approximately parallel to the axis X-X and contains a plurality of fluid, e.g.
15 air jets directed to have a component parallel to the axis X-X and a component in the direction of rotation R, that is normal to the axis and parallel to the walls 10. The jets lift the leaves off the drum, against the force of gravity and the centrifugal force, and project it away from the inlet and a little round the drum in the direction of rotation so that when it falls back, it does not fall directly over the (next) jet but completes another revolution
20 past the line of inspection 14 unless rejected. The action of the jets in the jet bar 20 is intended also to turn the article over. The drum 2 and the jet bar 20 are sufficiently long that in passage from one end 8 of the drum to the other 6, there is a high probability that an article will be turned over sufficiently for all its surfaces to be inspected. The direction and force of each jet can be tailored to a particular product and individually selected to
25 increase this probability.

A conveyor or flume 22 extends inside the length of the drum at such a position that articles pass it subsequent to passing the line of inspection 14. If the control means

(not illustrated) determines that an article should be rejected it is projected into the conveyor or flume to be transported out of the drum into a reject bin (not shown). For this purpose a bar 24 containing a plurality of fluid e.g. air jets, not illustrated individually, but individually selectable, is positioned outside the drum directed inwardly towards the conveyor or flume. The control means (not illustrated) is arranged to select one or more of the bar 24 jets to operate at a suitable time after the detection of a reject article, to propel the article into the conveyor or flume 22.

If the walls 10 are of a suitable material, e.g. transparent perforate material, it would be possible to inspect the articles on the inspection line 14 from outside the drum, perhaps "manually".

CLAIMS

1. Apparatus for inspecting articles, comprising a hollow drum having permeable walls and at one end an inlet for receiving articles onto an inside surface of the permeable walls; means for rotating the drum about an axis having at least a horizontal component at such speed that centrifugal force acting on the articles is sufficient to overcome the force of gravity acting on the articles, and progressing means for applying a first jet of fluid to the articles through the permeable wall, to displace the articles from the inside surface and in a direction away from the inlet.
2. Apparatus as claimed in claim 1, including rejection means for selectively applying a second jet of fluid to project rejected articles into means for removing rejected articles from the drum.
3. Apparatus as claimed in claim 1 or 2, including an inspection camera directed at the inside surface of the permeable wall, and control means responsive to the output from camera to reject articles according to predetermined criteria and to operate said rejection means to apply said second jet of fluid selectively to remove the rejected articles.
4. Apparatus as claimed in claim 3, wherein the rejection means is operable to apply a plurality of second jets selectively, and wherein the control means is operative to analyse output from the camera to select one or more second jets.
5. Apparatus as claimed in claim 4, wherein the camera is a line scan camera.
6. Apparatus as claimed in any preceding claim, wherein the first jet is arranged to displace articles in a direction having a component normal to the axis and parallel to the inner surface.
7. A method for inspecting articles, comprising conveying the articles through an inlet and onto an inside surface of permeable walls of a hollow drum; rotating the drum about an axis having at least a horizontal component at such speed that

centrifugal force acting on the articles is sufficient to overcome the force of gravity acting on the articles, and applying a first jet of fluid to the articles through the permeable wall, to displace the articles from the inside surface and in a direction away from the inlet.

8. A method as claimed in claim 7, including selectively applying a second
5 jet of fluid to project rejected articles into means for removing rejected articles from the drum.

9. A method as claimed in claim 7 or 8, including inspecting articles by
means of a camera directed at the inside surface of the permeable wall, and responsive
to output from the camera rejecting articles according to predetermined criteria and
10 applying said second jet of fluid selectively to remove the rejected articles.

10. A method as claimed in claim 9, including analysing output from the
camera to select one or more second jets.

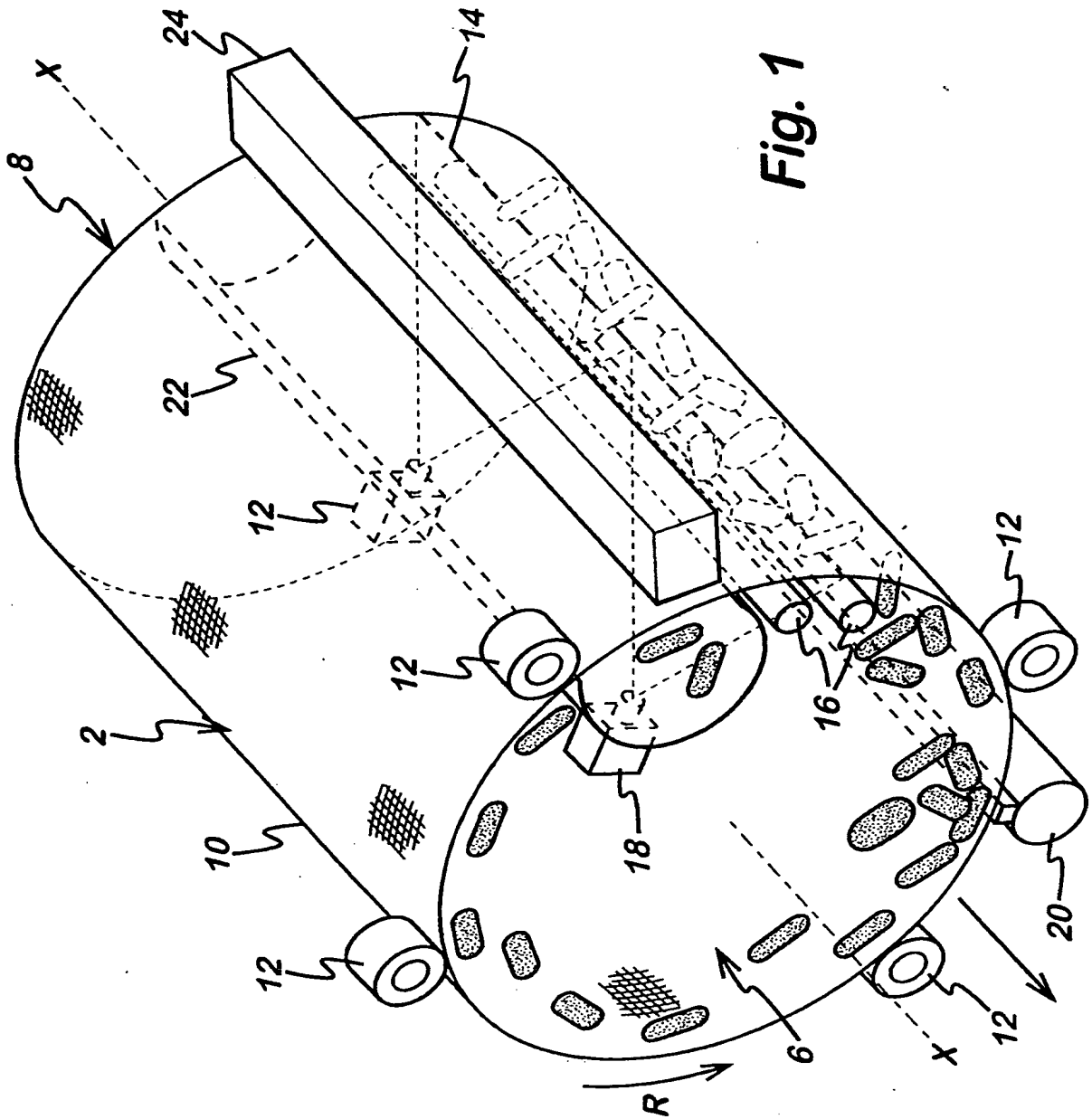


Fig. 2